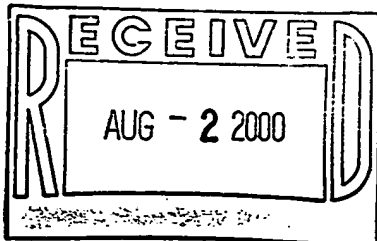PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To: DAVID P. GORDON
65 WOODS END ROAD
STAMFORD, CT 06905

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PCT

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of Mailing (day/month/year)	**28 JUL 2000**

Applicant's or agent's file reference	
GDC-136 PCT	IMPORTANT NOTIFICATION

International application No.	International filing date (day/month/year)	Priority Date (day/month/year)
PCT/US99/22651	29 SEPTEMBER 1999	02 OCTOBER 1998

Applicant
GENERAL DATACOMM, INC.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

   The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

   Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

   For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/US	Authorized officer
Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	Le Hien Luu
Facsimile No. (703) 305-3230	Telephone No. (703) 305-9650

Form PCT/IPEA/416 (July 1992)*

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference GDC-136 PCT	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/US99/22651	International filing date *(day/month/year)* 29 SEPTEMBER 1999	Priority date *(day/month/year)* 02 OCTOBER 1998

International Patent Classification (IPC) or national classification and IPC
IPC(7): G06F 15/16, 15/163, 16/177 and US Cl.:   709/223

Applicant
 GENERAL DATACOMM, INC.

---

1.   This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2.   This REPORT consists of a total of __3__ sheets.

   ☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority. (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of __∅__ sheets.

---

3.   This report contains indications relating to the following items:

   I   ☒   Basis of the report

   II   ☐   Priority

   III   ☐   Non-establishment of report with regard to novelty, inventive step or industrial applicability

   IV   ☐   Lack of unity of invention

   V   ☒   Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

   VI   ☐   Certain documents cited

   VII   ☐   Certain defects in the international application

   VIII   ☐   Certain observations on the international application

---

Date of submission of the demand 23 MARCH 2000	Date of completion of this report 19 JULY 2000
Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer Le Hien Luu *James R. Matthews* Telephone No. (703) 305-9650

Form PCT/IPEA/409 (cover sheet) (July 1998)*

I. Basis of the report

1. With regard to the elements of the international application:*

[X] the international application as originally filed

[X] the description:

pages _____1-17_____ , as originally filed

pages _____NONE_____ , filed with the demand

pages _____NONE_____ , filed with the letter of _____

[X] the claims:

pages _____18-20_____ , as originally filed

pages _____NONE_____ , as amended (together with any statement) under Article 19

pages _____NONE_____ , filed with the demand

pages _____NONE_____ , filed with the letter of _____

[X] the drawings:

pages _____1-2_____ , as originally filed

pages _____NONE_____ , filed with the demand

pages _____NONE_____ , filed with the letter of _____

[X] the sequence listing part of the description:

pages _____NONE_____ , as originally filed

pages _____NONE_____ , filed with the demand

pages _____NONE_____ , filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

[ ] the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

[ ] the language of publication of the international application (under Rule 48.3(b)).

[ ] the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/ or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

[ ] contained in the international application in printed form.

[ ] filed together with the international application in computer readable form.

[ ] furnished subsequently to this Authority in written form.

[ ] furnished subsequently to this Authority in computer readable form.

[ ] The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

[ ] The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. [X] The amendments have resulted in the cancellation of:

[X] the description, pages _____NONE_____

[X] the claims, Nos. _____NONE_____

[X] the drawings, sheets/fig _____NONE_____

5. [ ] This report has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

**Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

Form PCT/IPEA/409 (Box I) (July 1998)*

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. statement

Novelty (N)	Claims	1-15	YES
	Claims	NONE	NO
Inventive Step (IS)	Claims	1-15	YES
	Claims	NONE	NO
Industrial Applicability (IA)	Claims	1-15	YES
	Claims	NONE	NO

2. citations and explanations (Rule 70.7)

Claims 1-15 meet the criteria set out in PCT Article 33(2)-(4), because the prior art does not teach or fairly suggest that Simple Network Management Protocol commands include at least a PDU comprising: an identifier signifying that the PDU is a table block access request; an Object Identifier of a table to be accessed; an index to a row within the table to be accessed;and information identifying the number of rows to be accessed.
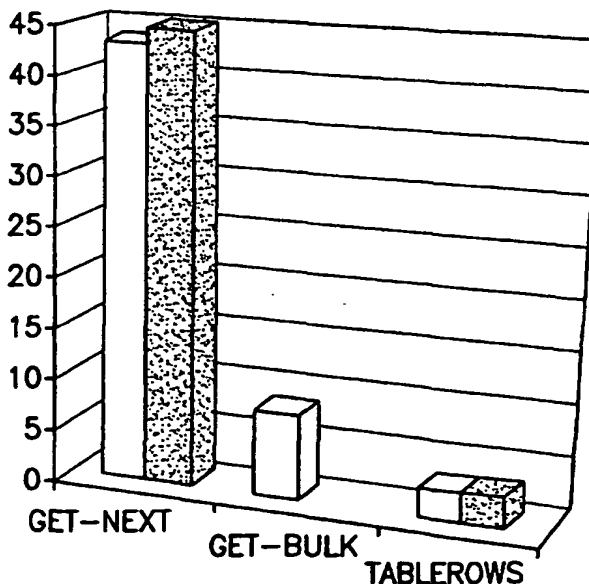
-------------------- NEW CITATIONS --------------------
NONE

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(54) Title: NETWORK MANAGEMENT INFORMATION PROCESSING

(57) Abstract

A method for supplying data from a table in a device responsive to network management protocol commands includes receiving a Protocol Data Unit (PDU) designated as a table block access request (TBAR), identifying the PDU as a TBAR, obtaining an Object Identifier (OI) of a table to be read from the PDU, obtaining an index to a row to be read from the table from the PDU, determining the number of rows to be read based on information obtained from the PDU, looking up information in the table based on the OI and the index, composing a response PDU containing information read from the table for multiple rows based on the number of rows to be read, and outputting a response packet (RP). Optionally, OIs are only included in the RP if requested, and abbreviated OIs are included in the RP. Network devices implementing the method are also provided.

CALCULATED TIME (SECONDS)
ACTUAL TIME (SECONDS)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/22651

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) :G06F 15/173
US CL : 709/223
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 709/223, 224, 232; 380/24; 705/16

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EAST, STN

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,802,309 A (COOK et al) 01 September 1998, col 2 line 4 - col 3 line 22	1-15
X	US 5,812,668 A (WEBER) 22 September 1998, col 65 line 9 - col 68 line 11	1-15

☐ Further documents are listed in the continuation of Box C.   ☐ See patent family annex.

	Special categories of cited documents		
"A"	document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier document published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed	"&"	document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 NOVEMBER 1999	17 APR 2000

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Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	Ivan C. Pierce, James R. Matthews
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Form PCT/ISA/210 (second sheet)(July 1992)*

PCT

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G06F 15/16, 15/163, 16/177	A1	(11) International Publication Number: WO 00/20981
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(81) Designated States: CA, KR, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: NETWORK MANAGEMENT INFORMATION PROCESSING

(57) Abstract

A method for supplying data from a table in a device responsive to network management protocol commands includes receiving a Protocol Data Unit (PDU) designated as a table block access request (TBAR), identifying the PDU as a TBAR, obtaining an Object Identifier (OI) of a table to be read from the PDU, obtaining an index to a row to be read from the table from the PDU, determining the number of rows to be read based on information obtained from the PDU, looking up information in the table based on the OI and the index, composing a response PDU containing information read from the table for multiple rows based on the number of rows to be read, and outputting a response packet (RP). Optionally, OIs are only included in the RP if requested, and abbreviated OIs are included in the RP. Network devices implementing the method are also provided.

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NETWORK MANAGEMENT INFORMATION PROCESSING

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the processing of information for network management. More particularly, but not exclusively, the present invention relates to the processing of information contained in tables for controlling a network.

2. State of the Art

In a distributed network such as the Internet, it is necessary to store various parameters, including routing information, at distributed points across the network and to extract that information for overall management of the network. Since different devices in a network may be made by different manufacturers and be of different types, it is desirable for communication of this information to be substantially device independent.

The Simple Network Management Protocol (SNMP) together with associated Management Information Base (MIB) structures have been designed to achieve device-independent management of a network and are widely used across the Internet. Basic details of SNMP may be found in any of a number of texts on the subject, an example of which is The Simple Book (An Introduction to Management of TCP/IP-based internets) by Marshall T. Rose published by Prentice-Hall 1991, the entire disclosure of which is incorporated herein by reference.

SUMMARY OF THE INVENTION

The invention is particularly concerned with the manipulation of data in tables such as a Management Information Base (MIB). Details of the structure of a MIB may be found in chapter 4, pages 91-130 of The Simple Book, referenced above.

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Entries within a MIB are associated with Object Identifiers
(OIDs) which may be lengthy strings. The invention is
particularly concerned with access to tables (such as a MIB)
using network management protocols such as the Simple Network
Management Protocol (SNMP), a discussion of which may be found
in chapter 5, pages 131-186, of The Simple Book.

In order to extract information from a table such as a MIB,
SNMP defines Protocol Data Units (PDUs) for exchanging messages
and commands and provides a "Get" command and a "Get Next"
command which allow information to be retrieved and a table to
be traversed effectively. The "Get Next" operator is described
on pages 140-142 of the Simple book. Whilst the "Get Next"
operator is a powerful tool for traversing a table, it can be
inefficient if blocks of data are to be accessed.

Version 2 of the Simple Network Management Protocol provides
a "Get Bulk" operator which effectively performs repeated "Get
Next" operations. This can lead to significant improvements in
efficiency compared to multiple "Get Next" operations. This can
result in a significant saving of Protocol Data Units (PDUs)
which must be exchanged and also in the total number of bytes
which must flow across the network.

However, pursuant to the invention, it has been appreciated
that more efficient access to large tables may yet be possible,
preferably in a manner not incompatible with existing SNMP
architecture. Studies pursuant to the present invention have
revealed that a significant amount of the data transferred may
comprise Object Identifiers (OIDs). Pursuant to the invention,
it has been appreciated that complete OIDs do not necessarily
need to be transmitted in every case. It has also been found,
pursuant to the invention, that certain operations such as the
extraction of a relatively small portion of a relatively large
table may be inefficient even when using the "Get Bulk"
operation.

It is an aim of the invention to provide methods of
extracting data from tables which are compatible with existing
network management protocol (such as SNMP) interactions, but
which may provide improved efficiency.

According to a first aspect, the invention provides a method
of supplying data from a table in a device which is responsive
to network management protocol, commands preferably Simple
Network Management Protocol commands. The method preferably
comprises eight steps:

receiving a Protocol Data Unit designated as a table block
access request;

identifying the Protocol Data Unit as a table block access
request;

obtaining an Object Identifier of a table to be read from
the Protocol Data Unit;

obtaining an index to a row to be read from the table from
the Protocol Data Unit;

determining the number of rows to be read based on
information obtained from the Protocol Data Unit;

looking up information in the table based on the Object
Identifier and the index to the row to be read;

composing a response Protocol Data Unit containing
information read from the table for a plurality of rows based on
the number of rows to be read;

outputting the response packet.

By providing an Object Identifier for the table and an index
to a row (preferably the start row), lengthy Object Identifiers
need not be communicated for every row or every table entry.
Furthermore, the method may allow immediate access to a given
block of rows, for example in the middle of the table, even when
the Object Identifiers of those rows are not known.

It will be appreciated that the Simple Network Management
Protocol is reviewed and updated from time to time and
modifications are proposed. In this specification, which term
includes the claims, references to Simple Network Management

Protocol includes derivatives and modifications of the protocol current at the time of filing (whether including enhanced, reduced or alternative functionality); indeed, a modified version of the basic protocol incorporating table access as defined herein is intended to be encompassed by the term. Devices which are responsive to a subset or derivative of SNMP commands are intended to be encompassed by the invention.

Another advantage is that the Object Identifiers of the rows and objects within the table need not be communicated in the response packet; preferably Object Identifiers are only communicated in the response packet if specifically requested. Preferably, if Object Identifiers for the rows are requested, a single Object Identifier, preferably abbreviated, is communicated for each row. It is well-known that Object Identifiers are hierarchical, the Object Identifier of an item within a table comprising the Object Identifier of the table with suffixes dependent on the row and column within the table. By "abbreviated" is meant sufficient identification information from the suffixes, optionally pre-pended with a further portion of the complete Object Identifier or a dummy prefix, but not including the entire Object Identifier.

Preferably, information representative of the number of rows actually included in the response packet is included in the response packet, at least when the number of rows supplied differs from the number of rows requested. This may facilitate determination by the requestor of the amount of information supplied and composition of a subsequent request for remaining information.

Preferably, the method includes selecting one or more columns from which data is to be included based on column identifier information within the received Protocol Data Unit. This may allow data to be selectively extracted from multiple columns and multiple rows within a single operation. Most preferably, the column identifier information is in the form of index information. This avoids the need to communicate the

Object Identifier to each column, and allows specified columns
to be accessed even when the Object Identifiers are not known.

In a second aspect, the invention provides a method, in a
network management device which issues and accepts network
management protocol, preferably Simple Network Management
Protocol, Protocol Data Units, of obtaining data from a table in
a remote device, preferably arranged to perform a method as
defined above. The method preferably comprises six steps:
determining an Object Identifier of a table in the remote
device to be accessed;
determining an index to the start of a block of rows from
which data within the table is required;
determining the number of rows to be accessed;
composing a Protocol Data Unit designated as a table block
access request and including information representative of on or
more of said determining steps ;
outputting the Protocol Data Unit to the remote device; and
obtaining said data from a response Protocol Data Unit
received from the remote device.

Preferably, the method further comprises determining whether
the received Protocol Data Unit contains all the information
requested and, if not, composing a further request for
information.

The method may further comprise supplying the information to
a management application.

In a third aspect, the invention provides a network device
comprising:
means for responding to Protocol Data Units received
containing network management protocol, preferably Simple
Network Management Protocol, commands;
means for identifying a received Protocol Data Unit
designated as a table block access request;

means for indexing a portion of a stored table based on an Object Identifier and an index to a row to be read from the table from the Protocol Data Unit;

means for determining the number of rows to be read based on information obtained from the Protocol Data Unit;

means for looking up information in the table based on the Object Identifier and the index to the row to be read; and

means for composing a response Protocol Data Unit containing information read from the table for a plurality of rows based on the number of rows to be read.

According to a fourth aspect, the invention provides a Protocol Data Unit comprising:

an identifier signifying that the Protocol Data Unit is a table block access request;

an Object Identifier of a table to be accessed;

an index to a row within the table to be accessed; and

information identifying the number of rows to be accessed.

The Protocol Data Unit preferably further comprises information identifying the number of columns in the table to be accessed and an identifier for each column.

It will be appreciated that the invention can be applied regardless of the information contained within the table to the access and provide a technical improvement in terms of more efficient data transfer and simplified access to large tables.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a graph illustrating a comparison between the amount of data to be transferred when access a large table according to conventional methods and according to an embodiment of the invention;

Fig. 2 is a graph illustrating a comparison between the amount of Protocol Data Units to be transferred when access a large table according to conventional methods and according to an embodiment of the invention;

Fig. 3 is a graph illustrating a comparison between the amount of time taken for table retrieval when access a large table according to conventional methods and according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An embodiment for use in an SNMP-compatible network device having a plurality of MIB tables stored therein will now be described. Details of conventional MIB tables and SNMP commands, together with details of Abstract Syntax Notation One (ASN.1) and Basic Encoding Rules (BER) encoding are assumed to be well-known and will not be described in detail; reference should be made to The Simple Book, together with references 40-53 in the bibliography thereon, or to any of the relevant standards, all of which are incorporated herein by reference.

By way of background summary information, basic formats of an SNMP message, a generic PDU, a request PDU, a Get PDU and a Get Next PDU will be set out, in ASN.1 syntax.

Firstly, a basic message format:-
```
        -- top-level message


            Message ::=
                  SEQUENCE {
                        version          -- version-1 for this RFC
                          INTEGER {
                             version-1(0)
                          },


                        community     -- community name
                          OCTET STRING,
```

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```
            data            -- e.g., PDUs if trivial
                ANY         -- authentication is being used
        }
```

Next, the format of a Protocol Data Unit:-

```
    -- protocol data units

        PDUs  ::=
                CHOICE {
                    get-request
                        GetRequest-PDU,

                    get-next-request
                        GetNextRequest-PDU,

                    get-response
                        GetResponse-PDU,

                    set-request
                        SetRequest-PDU,

                    trap
                        Trap-PDU
                }

    -- the individual PDUs and commonly used
    -- data types will be defined later


    END
```

The basic format of a request PDU will now be set out:-

```
        -- request/response information

            RequestID ::=
                    INTEGER

            ErrorStatus ::=
                    INTEGER {
```

```
                         noError(0),

                         tooBig(1),

                         noSuchName(2),

                         badValue(3),

                         readOnly(4)

                         genErr(5)

               }


    ErrorIndex ::=
               INTEGER



    -- variable bindings


    VarBind ::=
               SEQUENCE {
                    name
                         ObjectName,


                    value
                         ObjectSyntax

                    }


    VarBindList ::=
               SEQUENCE OF
                     VarBind
```

The format of a standard "Get" PDU is:-

```
     GetRequest-PDU ::=
          [0]
               IMPLICIT SEQUENCE {
                    request-id
                         RequestID,


                    error-status        -- always 0
                         ErrorStatus,


                    error-index         -- always 0
                         ErrorIndex,
```

```
                    variable-bindings
                        VarBindList
            }
```

The format of a "Get Next" PDU is:-

```
        GetNextRequest-PDU ::=
            [1]
                IMPLICIT SEQUENCE {
                    request-id
                        RequestID,

                    error-status        -- always 0
                        ErrorStatus,

                    error-index         -- always 0
                        ErrorIndex,

                    variable-bindings
                        VarBindList
            }
```

Further details of the components of the entities defined above and other background information may be found by reference to RFC 1157 or other standard texts.

According to this embodiment, we propose a modified PDU which we designate a Get Table Row message. This is defined below using the ASN.1 syntax:-

```
GetTableRow-PDU ::=
        SEQUENCE {
            request-id
                INTEGER,

        error-status
                INTEGER {
                    noError(0),
                    tooBig(1),
                    noSuchName(2),
                    badValue(3),
                    readOnly(4),
```

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```
                        genErr(5)
                },

                error-index
                        INTEGER,
                snmpp-version
                        INTEGER {
                                version1 (1)                -- First implementation
                },

                table-name
                        OBJECT-INDENTIFIER,         -- OID of the table being
retrieved
                start-index
                        INTEGER,                    -- starting row index for
retrieval
                max-rows                            -- maximum no. of rows to be
retrieved
                        INTEGER,                    -- -1 indicates "get all rows"
                table-size
                        INTEGER,                    -- No. of rows in table

                instances-included
                        INTEGER {
                                no(0),              -- Row instances not encoded
                                yes(1)              -- Row instances are encoded
                        },

                column-total
                        INTEGER,                    -- No.of columns to be retrieved

                column1
                        INTEGER,                    -- column id for first column
                column2
                        INTEGER,                    -- column id for second column
                ...
                columnN
                        INTEGER,                    -- column id for Nth column

                variable-bindings
                        varBindList
}
VarBind ::=
        SEQUENCE {
                row-instance1
                        OBJECT-IDENTIFIER,          -- optional instance OID for row
                value
                        objectSyntax                -- value for this row/column entry
        }
```

This command is intended to allow a management application
to retrieve arbitrary rows from a table without having to issue
repeated GetNext commands to get to the correct rows. For
optimum efficiency and flexibility, it is found to be highly

desirable that the command can access arbitrary columns, and not just complete rows.

An explanation of the fields in a GetTableRows request PDU as would be sent from a management application follows:-
- request-id
    The unique request id for this PDU
- snmpp-version
        Indicates the revision level of the SNMPP PDU (should always be set to 1).
    - table-name
        The OBJECT IDENTIFIER representing the table to be retrieved. For example, the interfaces table in rfc1213 would have a table name of **1.3.6.1.2.1.2.2**
    - start-index
        Identifies the first row index to be retrieved from the table. This represents essentially the row number in that table (starting 0). So, to start retrieving from the first row, start-index would be set to 0. To retrieve from the 25th row, start-index would be set to 24, etc.
    - max-rows
        Represents the maximum number of rows to be retrieved (if possible). If all rows from the start-index to end of table are required, this should be set to -1.
    - column-total
        Represents the total number of columns to be retrieved from the table (the column ids are encoded immediately after this object in the PDU).
    - column-id
        A column id is encoded for each of the columns requested. So, for example, if five columns had been requested, then five consecutive INTEGERS would be encoded representing the respective column ids. The id represents the conceptual column number for that table (starting 1). So, for example, consider the ifTable of rfc1213, the column-id for ifOperStatus

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would be 8, since this is the eighth conceptual column
in the table.

The request PDU will contain an empty varbind list
(since all the information above is sufficient to identify
what we are requesting).

Note: All the other objects exist in the request PDU, but
will have their default values set.

To implement this embodiment, the (modified) SNMP
agent of the network device must process an incoming
GetTableRows request and package the response message to
send back to the requestor. The agent should attempt to
include all the requested rows into the response PDU, but
due to the restrictions of message size, this may not be
possible. In these cases, it should send back as many rows
as it can, updating the associated fields to identify
precisely the rows it has returned (this is so that the
requestor can send another GetTableRows request message
amended to retrieve the remaining rows).

A GetTableRows response PDU should be sent to the
management application with the following fields set:-
-       request-id
        The unique request id for this PDU.
-       snmpp-version
        Indicates the revision level of the SNMPP PDU (should
        always be set to 1)
-       table-name
        The OBJECT IDENTIFIER representing the table to be
        retrieved. For example, the interfaces table in
        rfc1213 would have a table name of 1.3.6.1.2.1.2.2.
        This must match the request PDU.
-       start-index
        Identifies the first row index to be retrieved from
        the table. This represents essentially the row number
        in that table (starting 0). So, to start retrieving

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from the first row, start-index would be set to 0. To
retrieve from the 25th row, start-index would be set
to 24, etc. This must match the request PDU.
- max-rows
This will be set to the actual number of rows included
in this response PDU.
- table-size
Stores the actual size of the table requested (i.e.
how many rows exist in the table at that point in
time).
- instances-included
set to no(0) if the row instances have not been
encoded in the varbinds representing the first column
requested, otherwise set to yes(1) if they have.
- column-total
Represents the total number of columns retrieved from
the table (the column ids are encoded immediately
after this object in the PDU). This must match the
request PDU.
- column-id
A column id is encoded for each of the columns
requested. So, for example, then five consecutive
INTEGERS would be encoded representing the respective
column ids. The id represents the conceptual column
number for that table (starting 1). So, for example,
consider the ifTable of rfc1213, the column-id for
ifOperStatus would be 8, since this is the eighth
conceptual column in the table. Each of these
column-ids must match the request PDU.
- varbind list
A list of varbinds must be encoded which represent the
data contained in the rows returned. The order of the
varbind list is on a per-row basis. So, for example,
if five columns had been requested, the first five
varbinds would constitute the values for the first row
returned, where varbind1 represents the data for
column1, varbind2 contains the data for column2 and so

on. In most cases, the name of the varbind is not
encoded (see the later section on varbind encoding).

The SNMPP GetTableRows message is encoded with a
message type of 0xAF, which corresponds to:-
    ASN_CONTEXT 1 ASN_CONSTRUCTOR 1 0Xf

A variable binding list returned in a GetTableRows
response message will contain each of the values within the
table encoded as usual varbind objects. The varbind list
must always contain enough variables encoded in the varbind
list will be multiples of column-total.

The variable binding for each element in a row will be
encoded in order of column-ids requested. The object-name
of a varbind will only be encoded if the following two
criteria are met:-
    1.   The instances-included variable is set to yes(1)
    2.   The varbind being encoded represents the first
column-id of a row.

If the object name is encoded, it will represent the
instance oid identifying that row (starting with 0.0,
because the first two subids must each be encoded in a
single octet according to SNMP).

This is best explained by example, so consider the
ifTable and the TableRows request message has requested
two columns, namely ifAdminStatus (1.3.6.1.2.1.2.2.1.7) and
ifOperStatus (1.3.6.1.2.1.2.2.1.8).

The column-ids will be encoded as two INTEGERs, namely
7 and 8.

Supposing the response message was returning 3 rows (for ifIndex 1,2 and 3). The varbind list will be encoded as follows:-

Varbind	Object Name (row-Instance)	Value
1	0.0.1	up(1)
2	Not Encoded	up(1)
3	0.0.2	up(1)
4	Not Encoded	down(2)
5	0.0.3	testing (3)
6	Not Encoded	Down(2)

The above varbinds would represent the following three rows in the **ifTable**:-

ifIndex	ifAdminStatus	ifOperstatus
1	up(1)	up(1)
2	up(2)	down(2)
3	testing(3)	down(2)

The following pseudo-code outlines the basic steps to be performed to implement the embodiment (some of which will co-exist with other steps which are part of a conventional SNMP agent) :-

- Receive PDU
[Other SNMP processing]
- Check whether PDU designated "GetTableRows"
- If not so designated, skip to Continued Processing
- If so designated:-
        - Obtain OID of table to be read from table-name

- Obtain index to first row to read from start-index .

- Obtain number of rows to read from max-rows

- Obtain indices to columns to be read column1..N

- Check whether encoded row ids requested in

instances-included

- Look up information in specified table using indices

- Compose response packet including:-

    * Information read from table in varbinds

    * Number of rows actually read in max-rows

    * Row ids if specified in varbinds for first column

- Output response packet

[Continued Processing]

It will be appreciated that the ordering of information is not critical and can be changed, as can all labels used both for entities with the PDU and the PDU designation (the label GetTableRows being used here as a suitable label to designate a table block access request). The information contained in the PDU may be replaced by other combinations of information which achieve the same function (for example, the last row may be supplied in place of the first row, and the indexing performed in reverse). Not all functions need be included.

Each feature described above may be provided independently, unless otherwise stated.

Claims:

1.   A method of supplying data from a table in a device which is responsive to network management protocol commands, the method comprising receiving a Protocol Data Unit designated as a table block access request;

identifying the Protocol Data Unit as a table block access request;

obtaining an Object Identifier of a table to be read from the Protocol Data Unit;

obtaining an index to a row to be read from the table from the Protocol Data Unit;

determining the number of rows to be read based on information obtained from the Protocol Data Unit;

looking up information in the table based on the Object Identifier and the index to the row to be read;

composing a response Protocol Data Unit containing information read from the table for a plurality of rows based on the number of rows to be read;

outputting the response packet.

2.   A method according to Claim 1, wherein Object Identifiers are only included in the response packet if requested.

3.   A method according to Claim 1 or Claim 2, wherein if Object Identifiers for the rows are to be included in the response packet, a single Object Identifier is included for each row.

4.   A method according to Claim 2 or Claim 3 wherein abbreviated Object Identifiers are included in the response packet.

5. A method according to any preceding claim wherein information representative of the number of rows actually included in the response packet is included in the response packet, at least when the number of rows supplied differs from the number of rows requested.

6. A method according to any preceding claim including selecting one or more columns from which data is to be included based on column identifier information within the received Protocol Data Unit.

7. A method according to Claim 6, wherein the column identifier information is in the form of index information.

8. A method, in a network management device which issues and accepts network management protocol Protocol Data Units, of obtaining data from a table in a remote device, preferably arranged to perform a method according to any preceding claim, the method comprising:
determining:- (a) an Object Identifier of a table in the remote device to be accessed;
(b) an index to the start of a block of rows from which data within the table is required;
(c) the number of rows to be accessed;
composing a Protocol Data Unit designated as a table block access request and including information representative of said determining;
outputting the Protocol Data Unit to the remote device; and
obtaining said data from a response Protocol Data Unit received from the remote device.

9. A method according to Claim 8 further comprising determining whether the received Protocol Data Unit contains all the data requested and, if not, composing a further request for data.

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10. A method according to Claim 8 or Claim 9 further comprising supplying the data to a management application.

11. A method according to any preceding claim, wherein the network management protocol is Simple Network Management Protocol, or a derivative or modification thereof.

12. A network device comprising:

means for responding to Protocol Data Units received containing network management protocol commands;

means for identifying a received Protocol Data Unit designated as a table block access request;

means for indexing a portion of a stored table based on (a) an Object Identifier and (b) an index to a row to be read from the table, obtained from the Protocol Data Unit;

means for determining the number of rows to be read based on information obtained from the Protocol Data Unit;

means for looking up information in the table based on the Object Identifier and the index to the row to be read;

means for composing a response Protocol Data Unit containing information read from the table for a plurality of rows based on the number of rows to be read.

13. A device according to Claim 12, wherein the network management protocol is Simple Network Management Protocol, or a derivative or modification thereof.

14. A Protocol Data Unit comprising:

an identifier signifying that the Protocol Data Unit is a table block access request;

an Object Identifier of a table to be accessed;

an index to a row within the table to be accessed;

information identifying the number of rows to be accessed.

15. A Protocol Data Unit according to Claim 12 further comprising information identifying the number of columns in the table to be accessed and an identifier for each column.
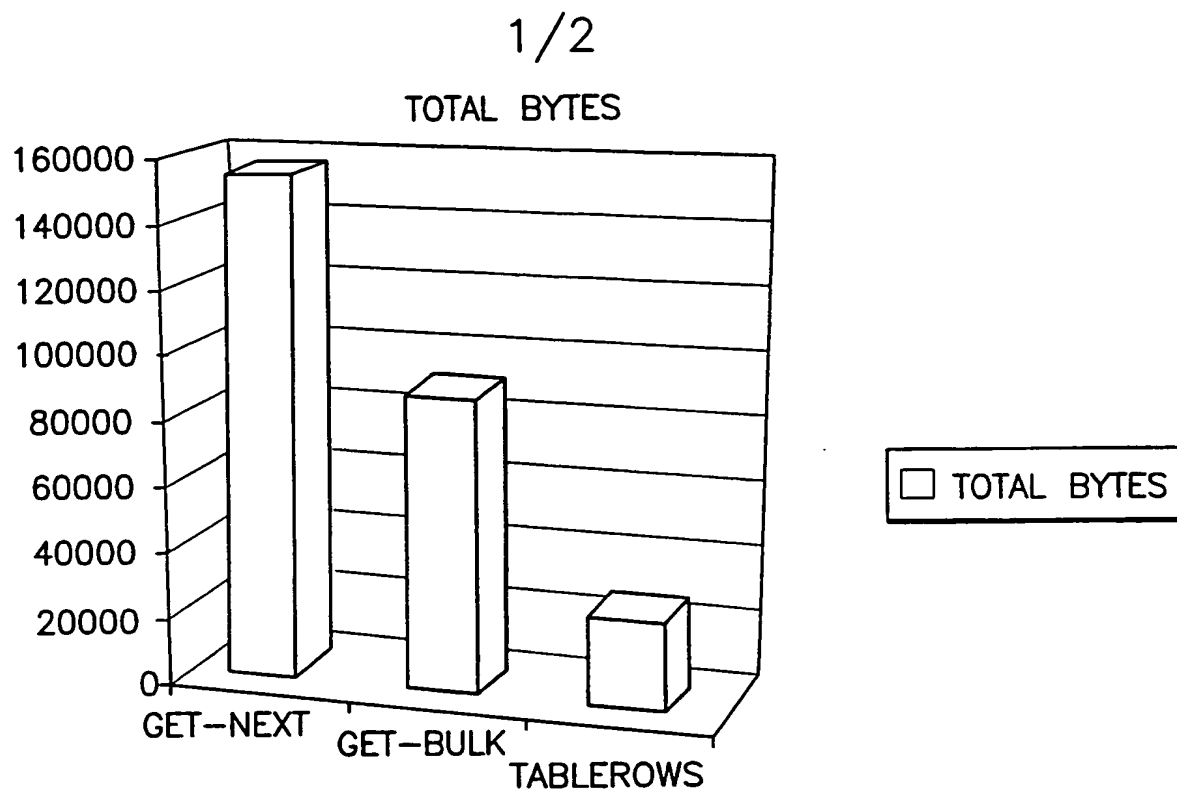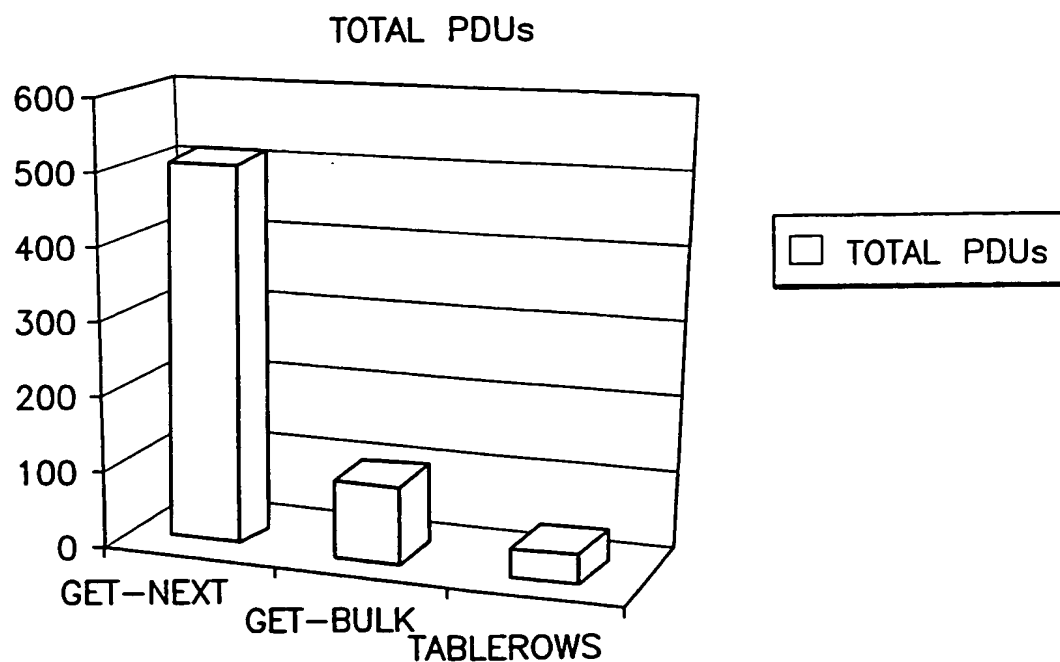
1/2
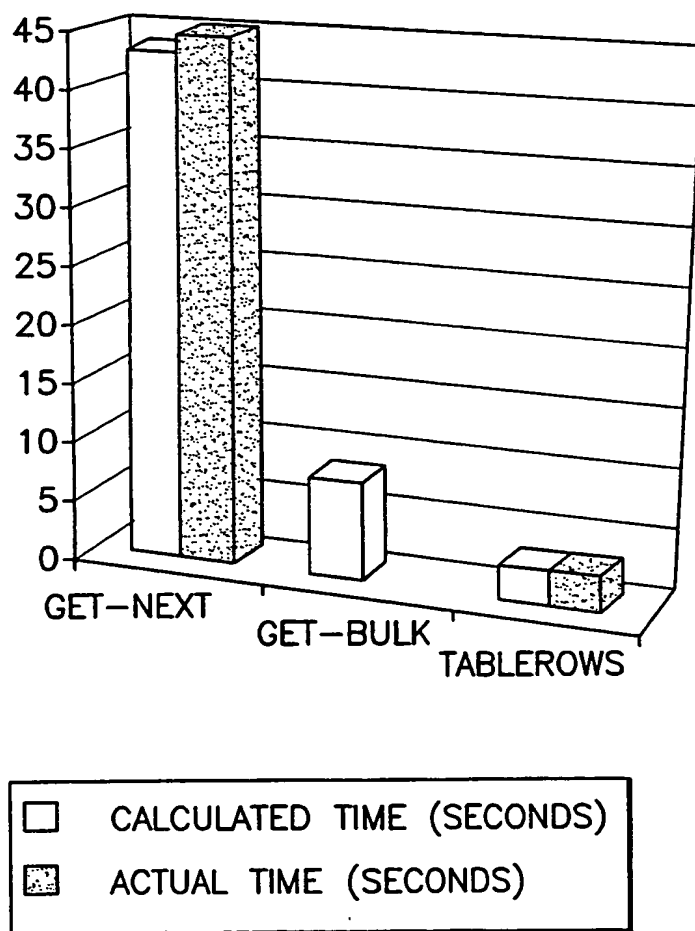
TOTAL BYTES

FIG.1

TOTAL PDUs

FIG.2

FIG.3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US99/22651

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :G06F 15/16, 15/163, 16/177
US CL : 709/223

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 709/223, 224, 232; 380/24; 705/16

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EAST, STN

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,802,309 A (COOK et al) 01 September 1998, col 2 line 4 - col 3 line 22	1-15
X	US 5,812,668 A (WEBER) 22 September 1998, col 65 line 9 - col 68 line 11	1-15

☐ Further documents are listed in the continuation of Box C.   ☐ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	
"E" earlier document published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 NOVEMBER 1999	10 DEC 1999
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-7201	Authorized officer Ivan C. Pierce, III _James R. Matthews_ Telephone No. (703) 308-1058

Form PCT/ISA/210 (second sheet)(July 1992)*

PATENT COOPERATION TREATY

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

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JUN 2 1 2001
Technology Center 2100

Applicant's or agent's file reference F.2228/WO	**FOR FURTHER ACTION**	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/GB 00/ 03116	International filing date *(day/month/year)* 14/08/2000	(Earliest) Priority Date *(day/month/year)* 18/08/1999	

Applicant ASTRAZENECA UK LIMITED	RECEIVED

This International Search Report has been prepared by this International Searching Authority and is transmitted to the application according to Article 18. A copy is being transmitted to the International Bureau.

APR 3 0 2001
Technology Center 2600

This International Search Report consists of a total of ____3____ sheets.

[X]   It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ]   the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ]   contained in the international application in written form.

   [ ]   filed together with the international application in computer readable form.

   [ ]   furnished subsequently to this Authority in written form.

   [ ]   furnished subsequently to this Authority in computer readble form.

   [ ]   the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ]   the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ]   **Certain claims were found unsearchable** (See Box I).

3. [ ]   **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [ ]   the text is approved as submitted by the applicant.

   [X]   the text has been established by this Authority to read as follows:

   PHARMACEUTICAL COMPOSITIONS COMPRISING A-(2-AMINOETHYL)-BENZOTHIAZOLONE AND DISODIUM CROMOGLYCATE OR NEDOCROMIL

5. With regard to the **abstract,**

   [X]   the text is approved as submitted by the applicant.

   [ ]   the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. _____

   [ ]   as suggested by the applicant.   [X]   None of the figures.

   [ ]   because the applicant failed to suggest a figure.

   [ ]   because this figure better characterizes the invention.

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year)
26 May 2000 (26.05.00)

International application No.	Applicant's or agent's file reference
PCT/US99/22651	GDC-136 PCT

International filing date (day/month/year)	Priority date (day/month/year)
29 September 1999 (29.09.99)	02 October 1998 (02.10.98)

Applicant
GYMER, David et al

1. The designated Office is hereby notified of its election made:

   [X] in the demand filed with the International Preliminary Examining Authority on:

   23 March 2000 (23.03.00)

   [ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

   [ ] was not

   made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Juan Cruz
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

Form PCT/IB/331 (July 1992)

US9922651

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7   A61K31/47   A61K31/43   A61K31/35

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7   A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EMBASE, CHEM ABS Data, MEDLINE, EPO-Internal, BIOSIS, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 93 24473 A (BROWN ROGER CHARLES ;CHESHIRE DAVID RANULF (GB); FISONS PLC (GB);) 9 December 1993 (1993-12-09) cited in the application page 7, line 22 - line 29; example 6	1-17
Y	LAL S. ET AL: "Nedocromil sodium is more effective than cromolyn sodium for the treatmen of chronic reversible obstructive airway disease." CHEST, (1993) 104/2 (438-447). , XP000986434 page 439, column 1, paragraph 2	1-14
	-/--	

| X | Further documents are listed in the continuation of box C. | X | Patent family members are listed in annex. |

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
1 March 2001	07/03/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Leherte, C

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	LURIE A. ET AL: "Long-term management of reversible obstructive airways disease in adults." LUNG, (1990) 168/SUPPL. (154-167). , XP000986437 page 157, paragraph 3 -page 158, paragraph 1	1-14
Y	GONZALEZ J.P. ET AL: "Nedocromil sodium. A preliminary review of its pharmacodynamic and pharmacokinetic properties, and therapeutic efficacy in the treatment of reversible obstructive airways disease." DRUGS, (1987) 34/5 (560-577). , XP000986536 page 575, column 1	1-14

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
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